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Inside this issue: Scientific writing

In this issue, the CCDR Editorial Office begins a series of articles on scientific writing. The goal of this series is to identify best reporting practices for different types of manuscripts in order to facilitate efficient manuscript development and review, and produce high quality articles that are a pleasure to read. These guides are consistent with those found on the EQUATOR Network and have been adapted for writing and reporting about infectious diseases. In addition, read about the public health response to the recent avian influenza outbreaks among poultry in British Columbia and enjoy a riveting eye-witness account of what it was like to work in a laboratory as part of an Ebola outbreak response team in West Africa.

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International Committee of Medical Journal Editors. Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals Updated December 2014.
http://www.icmje.org/icmje-recommendations.pdf

The EQUATOR Network. Enhancing the QUAlity and Transparency Of health Research: The resource centre for good reporting of health research studies.
http://www.equator-network.org/

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Canada

Public health response to outbreaks of Avian Influenza A(H5N2) and (H5N1) among poultry – British Columbia, December 2014-February 2015

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Abstract

In December 2014, the first detection in Canada of a highly pathogenic avian influenza A (HPAI) virus was reported in poultry within the Fraser Health Authority of British Columbia. It was the second outbreak of HPAI from Eurasian H5 reassortment viruses in North America. The Fraser Health Authority provided the lead public health coordination for this response as well as consultation and support to the occupational health response.

The public health response focused on contact tracing, monitoring and follow-up for household, farm worker and other community contacts exposed on the affected farms. A total of 50 contacts were identified. Contacts received daily active monitoring by public health nurses for seven days from their last exposure and were advised to self-monitor until day 10. All contacts and other household members were recommended seasonal influenza vaccination to protect against further possible reassortment with human influenza viruses circulating within the community at the time. A total of 26 (52%) contacts were recommended chemoprophylaxis for ongoing exposure to the affected barns and flocks, of whom only 11 (42%) initiated this. During the seven-day active surveillance period, four contacts developed acute respiratory symptoms and influenza B was identified in one individual.

Local area health care providers and acute care facilities were alerted to the outbreak and public messaging was provided regarding the human health risks from avian influenza. Collaboration between health and agriculture at the local, regional, provincial and federal levels was key to a rapid response to this outbreak.

Introduction

In December 2014, the first detection in North America of a highly pathogenic avian influenza A (HPAI) virus with Eurasian H5 lineage genes was reported in poultry within the Fraser Health Authority (FHA) of British Columbia (BC), Canada. This was a highly pathogenic avian influenza H5N2 subtype resulting from mixing (i.e. genetic reassortment) between Eurasian lineage highly pathogenic avian influenza H5N8 and low pathogenic avian influenza virus of North American wild bird lineage

The initial detection was followed by further reports of domestic and wild or captive bird infections with Eurasian lineage highly pathogenic avian influenza H5N8, H5N2 and H5N1 reassortment viruses in the Pacific Northwest of the United States (US) in December 2014 and January 2015 and additional detection of the same novel highly pathogenic avian influenza H5N1 reassortment virus in poultry in the FHA in February 2015 (1,2).

These detections represent the first outbreak of highly pathogenic avian influenza from Eurasian H5 reassortment viruses in North America. The term "highly pathogenic" refers to the spectrum of illness seen in birds, not humans. Affected flocks have experienced severe disease and high death rates, but there have been no human cases associated with these H5 viruses. In general, human infections with avian influenza viruses are rare and do not spread easily from person to person; however surveillance for animal-human transmission is essential for monitoring for the risk of human illness, particularly with a novel reassortment virus. This report provides details related to the public health response to the highly pathogenic avian influenza H5N2 and H5N1 reassortment virus detections in poultry by the Fraser Health Authority.

Avian influenza virus infection in birds

Between December 1 and 19, 2014, the FHA, located within the south western Lower Mainland Region of BC which borders on the US, was notified of 11 commercial and one non-commercial poultry premises infected with highly pathogenic avian influenza H5N2. The report was the first regarding the Eurasian lineage highly pathogenic avian influenza H5 virus in North America. It is the second outbreak of an HPAI H5N2 strain in North America, after an outbreak in Pennsylvania in 1983, and previous outbreaks due to LPAI H5N2 viruses of North American lineage had been reported in West Virginia in 2007, British Columbia in 2009, and Manitoba in 2010 (3). Phylogenetic analysis of the HPAI H5N2 virus associated with the 2014 outbreak reveals that it is a novel reassortant virus A/turkey/BC/FAV10/2014 (H5N2) containing gene segments (GenBank Accession Numbers: KP307954-KP307961) from a Eurasian lineage HPAI H5N8 virus (including the Eurasian H5 clade 2.3.4.4 gene) and segments (including the N2 gene) from a typical North American LPAI virus of wild bird origin (4, 5).

Subsequent to the HPAI H5N2 outbreak in BC, the United States Department of Agriculture (USDA) reported several detections of novel reassortant HPAI viruses of Eurasian H5 lineage (H5N2, H5N8, and H5N1) in domestic and wild or captive birds in Oregon, Washington, Idaho, Utah and California between December 2014 and February 2015 (6). These were the first detections of HPAI subtypes H5N8 and H5N1 in birds in North America and are believed to have been introduced through co-mingling of wild birds. On February 6, 2015, the FHA was also notified of a non-commercial egg layer flock farm where HPAI A H5N1 was identified (A/Chicken/BC/FAV2/2015 (H5N1)), with sequencing identifying the same North American wild bird lineage and nearly identical H5N1 virus as had been recently detected in Washington State (1). This strain of H5N1 is genetically different from the avian H5N1 viruses that had caused human illness in other countries.

In total, the 11 farms and two backyard flocks affected within the region included a mix of turkey (n=3), broiler breeder (n=7), table egg layer (n=1) and non-commercial flocks (n=2, including one with H5N1 reassortment). Over 245,000 birds have either died from the disease or have been humanely destroyed as part of the biosecurity response to the HPAI H5N2 and H5N1 detections in poultry in the region, coordinated through the Canadian Food Inspection Agency (CFIA), the BC Ministry of Agriculture and partner agencies (7).

Public health response measures

Building on previous avian influenza outbreaks in the region, notably the experience during the 2004 H7N3 outbreak, the FHA's regional public health response has focused on contact tracing, monitoring and follow-up for household, farm worker and other community contacts exposed on the affected farms (8,9). The FHA does not conduct contact tracing for CFIA contractors and other individuals occupationally exposed as part of the biosecurity response.

A total of 50 contacts were identified from the 13 affected premises: 35 (70%) were male and the median age was 42 years old (range: 12-75 years). Contacts were assessed for their ongoing exposure and last date of exposure to the affected birds and were educated on the signs and symptoms of influenza-like illness (ILI) and instructed on self-monitoring and immediate reporting if any ILI symptoms developed. Contacts received daily active monitoring by public health nurses for seven days from their last exposure and advised to self-monitor until day 10. Given the ongoing destruction and disposal measures on affected premises, contacts also received a follow-up phone call at day 17 to confirm no new exposures and to ensure that they remained asymptomatic.

All contacts and other household members were recommended seasonal influenza vaccination to protect against further possible reassortment with human influenza viruses circulating within the community at that time, notably A(H3N2) (10). A total of 26 (52%) were immunized either from previously in the season, or at the time of follow-up by public health. Contacts with ongoing exposure to the affected barns and flocks at the time of initial follow-up were recommended to initiate with antiviral chemoprophylaxis with oseltamivir and continue with daily dosing until seven days from last exposure. A total of 26 (52%) were recommended chemoprophylaxis, of whom only 11 (42%) initiated the antiviral prophylaxis.

During the seven-day active surveillance period, four contacts developed acute respiratory symptoms of cough or runny nose, but did not report fever and so did not meet the case definition for ILI. Nasopharyngeal swabs were obtained from all four symptomatic contacts. Influenza B was identified in one individual and the other three specimens were negative for influenza A and B. Two of the symptomatic contacts initiated treatment doses of oseltamivir with the onset of symptoms as a precautionary measure while nasopharyngeal swab results were pending.

Local area health care providers and acute care facilities were alerted to the outbreak in early December and provided recommendations on the evaluation and management of symptomatic patients associated with infected farms. The FHA also disseminated public messaging on the human health risks from avian influenza to area poultry and swine farms through industry association liaisons. Messages included recommendations on receiving the seasonal influenza vaccine (publicly funded for all poultry workers in BC) and the routine use of personal protective equipment. CFIA is the lead agency for coordination of the occupational health and safety for those employed as part of the biosecurity response.

Collaboration between health and agriculture at the local, regional, provincial and federal levels enabled a rapid response to this outbreak and the FHA has led public health coordination including consultation and support to the occupational health response.

Conclusion

The threat of pathogenic avian influenza from Asia (e.g., H5N1 and H7N9) with pandemic potential for humans requires vigilance in identifying changing epidemiology and novel reassortments. The current outbreak of HPAI H5N8 in poultry in Europe is the first European detection of this strain, previously detected in wild birds in Asia (11). The identification of a Eurasian lineage HPAI H5 virus in North America poses a concern for the potential introduction of the pathogenic zoonotic avian influenza strain from Asia to North America. With H5N2 and H5N1 detections in BC and H5N2, H5N8, and H5N1 detections in five north western states in the US, there is an increased likelihood of human exposure and infection in Canada (1).

As of the end of February 2015, there have been no human cases of H5N2, H5N8 or H5N1 identified through the active surveillance associated with the recent outbreaks in North America. However, some avian influenza H5 viruses can cause human infection, as demonstrated by the widespread A(H5N1) outbreak in Asia and parts of Africa (718 cases/413 deaths from January 2003 to 23 January 2015) (12).

On a global level, almost all cases of human infection with avian influenza H5 viruses have been reported in persons in close contact with infected or dead birds. Human-to-human transmission is rare and the risk of community-level spread is low. Global preventive measures therefore focus on those in closest contact with affected birds. Updated guidance from the Centers for Disease Control and Prevention (CDC) has been issued for human exposures to these strain types (13). Ongoing bird surveillance (both farm and wild) for notifiable avian influenza continues within the affected region including timely public health follow-up for all individuals potentially exposed to infected birds.

Acknowledgements

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Conflict of interest

None

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None

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Outbreak reporting guide

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Outbreak reports describe an outbreak once it is complete. They summarize how the outbreak was detected, the investigations that were conducted, the interventions that were carried out to control it, provide descriptive epidemiology and outcomes. They are useful to identify emerging risks and to describe new investigations or intervention techniques. Outbreak reports are typically 2,000- 2,500 words in length - excluding the abstract, tables and references.

The *Canada Communicable Disease Report* (CCDR) has adapted the Outbreak Reports and Intervention studies Of Nosocomial infection (ORION) reporting guideline (1) for community-based outbreaks.

Table 1 provides an outbreak report checklist and **Figure 1** illustrates an example of an epidemic curve, or histogram in which the number of new cases of a disease is plotted against an interval of time to describe a specific outbreak.

As with all submissions, check CCDR's Information for authors (typically published in January every year with the first issue of each new volume) for general manuscript preparation and submission requirements.

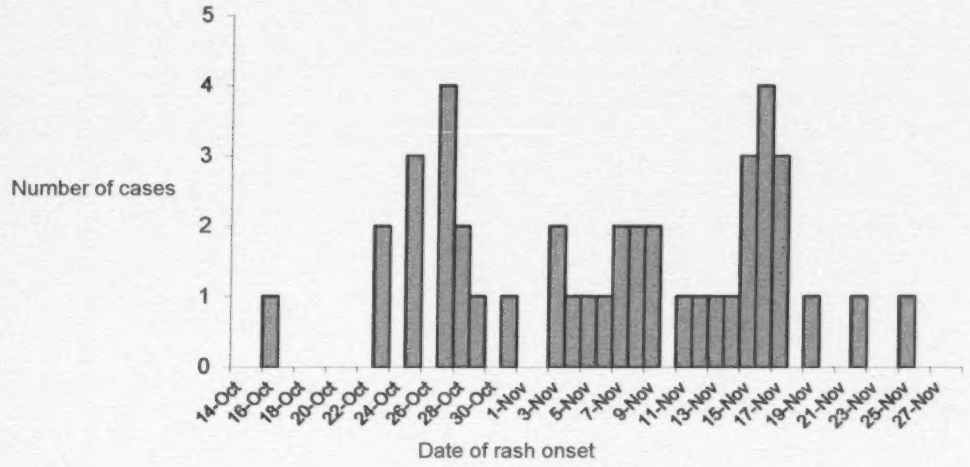
Table 1: Checklist of items to include when reporting on an outbreak

Reporting item	N°[1]	Description
Title		
Title	1	Compose a title that includes the term "outbreak", the disease, population or place and time.
Abstract		
Structured summary	2	Use a structured format for the abstract with the following section headings: Background, Objective, Methods, Outcome and Conclusions.
Introduction		
Setting	3	Describe the setting (community, hospital, etc.) where the outbreak occurred.
Identification	4	Describe the events that led to the discovery of the index case of the outbreak.
Background	5	Provide the scientific context (e.g., describe the organism and whether it is emerging, epidemic, endemic etc.).
Rationale	6	Identify the clinical and public health rationale to report outbreak (e.g., need for heightened awareness, demonstration of a new investigation or intervention technique).
Objective	7	Articulate the objective of the outbreak report. (e.g., "The objective of this report is to describe the epidemiological, diagnostic and genetic investigation of the outbreak that occurred in –).
Method		
Overview	8	Identify the start and finish dates of the outbreak and the date the investigations began. Describe how the end date was determined including the incubation period and date of the last reported case.
Case finding and data collection	9	Provide the case definitions (including confirmed, probable and under investigation if applicable).
	10	Describe data collection activities (for person, time and place) including any questionnaire development (clinical history, risk factor assessment).

Investigations	11	Provide a systematic description of how the outbreak was investigated including - Laboratory investigations, and - Environmental sampling.
Epidemiologic and statistical analyses	12	Describe any analytical methods used assess the outbreak (e.g., risk factor analysis, survival analysis, estimation of background rates).
	13	Reference any complex analytical methods used (e.g., social network analysis, estimation of R0).
	14	Include any sub-group analyses, what was done to control for interactions and confounding factors and how missing data and reporting delays were addressed.
Interventions	15	Describe the clinical and public health measures that were put in place to control the outbreak including as applicable including - Exposure history, - Health risk assessment, - Clinical treatments, and - Public health measures (e.g., quarantine, contact tracing, surveillance, immunization clinics, risk communications etc.).
Results		
Descriptive epidemiology	16	Provide an overview of what happened by person, time and place.
Ancillary analyses	17	Provide subgroup analyses and describe the assessment of interactions and confounders as indicated.
Complications	18	Identify any complications, such as hospitalizations and deaths.
Epidemic curve	19	Provide a figure showing the epidemic curve. In the title include the disease, population/place and time (year).
Frequency table	20	Include a table with demographic characteristics (e.g., age and sex) and symptom frequency, if applicable.
Discussion		
Key results	21	Summarize key findings that relate to the report objective, highlighting the new or important aspects of the outbreak and their significance.
Comparison	22	Consider these findings in relation to the current literature.
Strengths and weaknesses	23	Identify strengths and weaknesses of the outbreak investigation and response.
Conclusion	24	Ensure conclusions address objective and follow from the results.

[1] N° Number

Figure 1: Example of an epidemic curve for a measles outbreak (2)



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Surveillance summary reporting guide

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Surveillance reports provide essential information about a disease or health-related condition according to person, time and place. They often provide the basis to identify burden of illness and may include related information, such as trends in risk factor frequency or prescribing practices. Surveillance reports inform strategies to address targeted health conditions and may identify the need for additional clinical care or public health action. They can be summaries of larger reports published in the grey literature and, increasingly, may link to a complete surveillance dataset. Surveillance reports are approximately 2,000-2,500 words in length - excluding the abstract, tables and references.

The *Canada Communicable Disease Report* (CCDR) supports the use of reporting guidelines, including those collected by the Enhancing the QUAlity and Transparency Of health Research (EQUATOR) Network (1). However, the EQUATOR Network does not currently provide guideline for surveillance reports, so the CCDR has developed this one based on other checklists, a guideline for evaluating surveillance systems (2) and recent trends in Open Science.

Table 1 provides CCDR's checklist for surveillance reports. **Figure 1** illustrates an example of how surveillance data is typically summarized graphically with incidence on the *y* axis and time on the *x* axis.

As with all submissions, check CCDR's Information for authors (published in January every year with the first issue of each new volume) for general manuscript preparation and submission requirements.

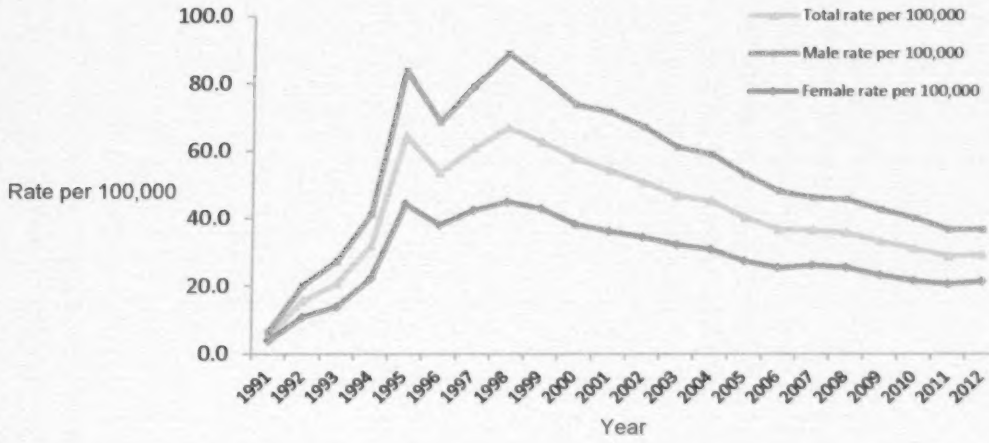
Table 1: Checklist for surveillance reports

Reporting item	N°[1]	Description
Title		
Title	1	Compose a title that includes the name of the health condition, population, time and place.
Abstract		
Structured summary	2	Provide a structured abstract including the following sub-headings: Background; Objectives; Methods; Results; and Conclusions.
Introduction		
Context	3	Summarize the current situation regarding the health condition under surveillance and identify why it is important.
Objectives	4	State the objective of the surveillance report.
Methods		
Setting	5	Describe the setting, locations and dates of the surveillance period.
Population	6	Describe the population under surveillance.
Definitions	7	Provide definitions for each health event under surveillance, including case definitions and any public health interventions.
Information sources	8	Describe all data sources, including the objective of any surveillance systems, what data were collected and how data were gathered, transferred and stored.
Supplementary data	9	If appropriate, note where to access supplemental material (e.g., www.opendata.gc.ca).
Data quality, missing data and reporting delays.	10	Describe how the data quality was assessed. Explain how missing data were addressed. If data is reported by date of diagnosis or symptom onset, include a statement

		about whether the data for the most recent periods may be revised.
Data analysis	11	Describe any analytical methods used providing sufficient detail to enable a knowledgeable reader with access to the original data to judge its appropriateness and to assess the reported results.
Results		
Descriptive data	12	Provide a summary of the descriptive data, including demographics.
Data Quality	13	Report on data quality (e.g., completeness, missing data, under reporting,)
Analytic data	14	Provide a summary of the analysis including (when indicated) estimates of trends. When applicable, point estimates should include appropriate indicators of measurement error such as 95% confidence intervals (e.g., average annual percentage change used to describe trends or odds ratios used to describe subgroup differences).
Figures	15	Create the minimum number of figures to highlight key results. Create a title that includes person, time and place.
Discussion		
Key results	16	Summarise key results with reference to study objectives
Comparison	17	Consider these findings in relation to the current literature.
Strengths and weaknesses	18	Discuss strengths and weaknesses of the study (data quality, completeness, sources of potential bias).
Interpretation and generalizability	19	Provide a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies and other relevant evidence.
Conclusion	20	Ensure conclusions address objective and follow from the results.

[1] N°: Number

Figure 1: Rates of reported cases of Hepatitis C in Canada [1] by sex, CNDSS [2], 1991-2012 (3)



[1]Includes PEI, ON, SK, AB, BC 1991-2012; NL, NB, NT 1993-2012; YT 1994-2012; NS, QC 1996-2012; MB 1999-2012; NU 1999-2006. For rate calculation, population denominators were adjusted to include only those jurisdictions for which data were available in a given year.
[2]CNDSS = Canadian Notifiable Disease Surveillance System

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Systematic review reporting guide

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Systematic reviews summarize the state of knowledge about a topic. They clarify both what is known and what needs further study and are used to stay up-to-date, to inform the development of advisory statements and clinical practice guidelines and to identify priorities for future research. They are typically 2,000-2,500 words in length - excluding the abstract, tables and references.

The *Canada Communicable Disease Report* (CCDR) endorses the widely-accepted reporting guideline, the Preferred Reporting Items of Systematic reviews and Meta-Analyses (PRISMA) (1). This guide was initially developed for health care interventions and has now been adapted for other uses (2, 3, 4).

Table 1 provides the PRISMA checklist. **Figure 1** illustrates a flow diagram that identifies how the initial number of studies identified during a literature search was pared down to the studies for review.

There are some additional considerations for systematic reviews on infectious disease topics. These include the need to consider differences across studies in laboratory methods used for the identification of infectious diseases, the presence or degree of antibiotic resistance and how case definitions were used to interpret laboratory results. Generic names are used to identify antibiotics or vaccines; brand names may be noted in brackets upon first use.

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Table 1: PRISMA Checklist for systematic reviews

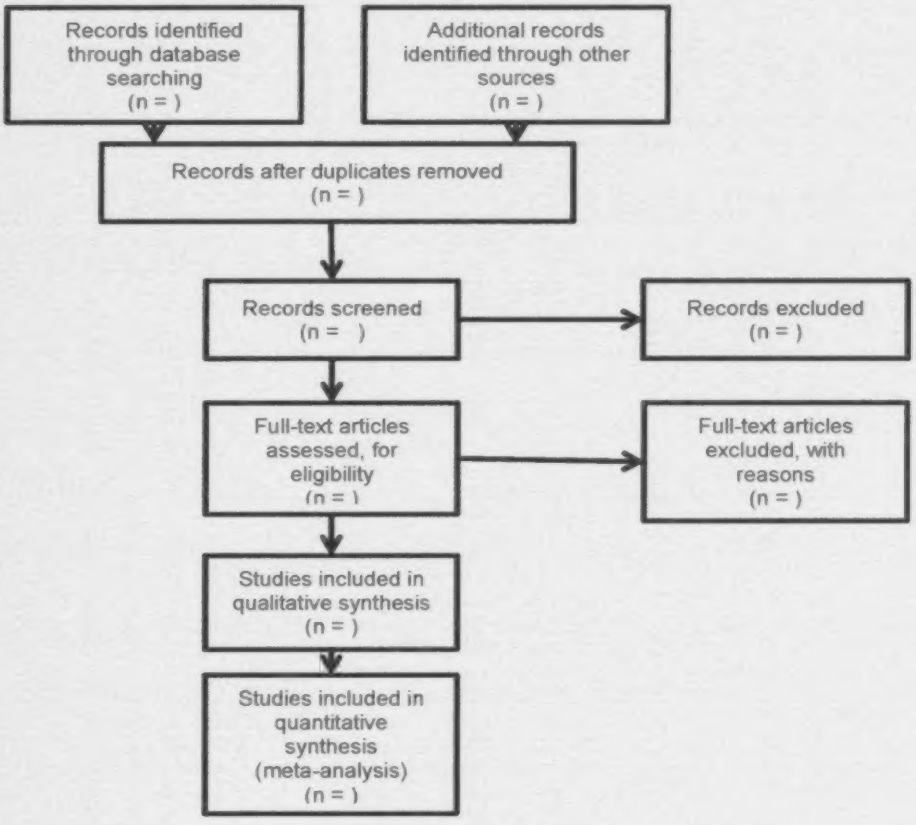
Reporting item	N°[1]	Description
Title		
Title	1	Identify the report as a systematic review, meta-analysis or both.
Abstract		
Structured summary	2	Provide a structured abstract including the following subheadings: Background; Objectives; Data sources; Study selection; Synthesis; Conclusions and, when applicable, systematic review registration number.[2]
Introduction		
Rationale	3	Describe the rationale for the review in the context of what is already known.
Objectives	4	Provide an explicit statement of questions being addressed with reference to Participants, Interventions, Comparisons, Outcomes and Study design (PICOS).
Methods		
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., website address) and, if available, provide registration information including registration number.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.

Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.
Study selection	9	State the process for selecting studies (e.g., screening, eligibility, included in systematic review and, if applicable, included in the meta-analysis).
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level) and how this information is to be used in any data synthesis.
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression) and if done, indicate which were pre-specified.
Results		
Study selection	17	Provide numbers of studies screened, assessed for eligibility and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: simple summary data for each intervention group and effect estimates and confidence intervals, ideally with a forest plot.
Synthesis of results	21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.
Risk of bias across studies	22	Present the results of any assessment of risk of bias across studies (see Item 15).
Additional analysis	23	Provide the results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).
Discussion		
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users and policy makers).
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias) and at review-level (e.g., incomplete retrieval of identified research, reporting bias).

Conclusions	26	Provide a general interpretation of the results in the context of other evidence and implications for future research.
Funding		
Funding	27	Describe the sources of funding for the systematic review and other support (e.g., supply of data) and role of funders for the systematic review.

[1] N[o]: Number
[2] Description of the abstract has been modified for the Canada Communicable Disease Report (CCDR).
[3] Reflects correction as noted on: http://www.prisma-statement.org/statement.htm.

Figure 1: PRISMA 2009 flow diagram


Records identified through database searching (n =)
Additional records identified through other sources (n =)
Records after duplicates removed (n =)
Records screened (n =)
Records excluded (n =)
Full-text articles assessed, for eligibility (n =)
Full-text articles excluded, with reasons (n =)
Studies included in qualitative synthesis (n =)
Studies included in quantitative synthesis (meta-analysis) (n =)

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Commentary reporting guide

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Commentaries are opinion papers that are designed to stimulate thinking and debate. They identify an issue, place it in a larger context and then offer some insights to educate, motivate or formulate an opinion. They are typically 1,000-1,500 words in length and have 10-15 references.

Commentaries have an engaging title and a text abstract of 150- 200 words.

The introduction is typically two to four paragraphs that identify an issue and state why it is important. The introduction articulates a position and outlines the key arguments to support that position.

The body of the commentary is five to eight paragraphs and provides an analysis of the issue. A paragraph or two can be provided to develop each of the arguments and consider strengths, weaknesses (or counter-arguments) as well as policy and practice implications. Assertions are supported with key references. Examples may be used to illustrate or support a point. A table summarizing key information may be useful.

The conclusion is one or two paragraphs. It highlights the key message of the commentary and provides recommendations for moving forward or next steps.

As with all submissions, check CCDR's Information for authors (published in January every year with the first issue of each new volume) for general aspects of manuscript preparation and submission requirements.

Thirty days in Sierra Leone

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It was September 29, 2014. On that day, 6500 cases of Ebola with 3500 deaths had been reported in West Africa; the first patient with Ebola in the United States had been admitted to hospital and was about to transmit the virus to two nurses. Ebola was sweeping through West Africa and knocking on North America's door. I was running one of the Public Health Agency of Canada's (PHAC) National HIV Laboratories and the boss walked into my office and said: "Brooks, if you want to make a contribution to public health, now is your time." Fifteen minutes later, via a teleconference, I had volunteered to perform Ebola diagnostics at one of PHAC's National Microbiology Laboratories (NML) Mobile Field Laboratories in Sierra Leone.

As an infectious diseases physician, my interests had always been in emerging infections and this Ebola outbreak was my chance. My wife and family knew my passion and urged me to go. Within a few short days, I had received the green light from my Director, rearranged my clinics, organized coverage for my patients, handed off my files and flew to Winnipeg for lab training. People at the NML took time out of their busy schedules to provide me with the training that would ensure I had the skills I needed. The NML Operations Center fully outfitted me with everything I would need to keep me going in the jungle. Occupational health fit tested me for my respirator and medical staff provided me with a first aid kit, bed net, mosquito repellant and a bucket of antibiotics. I felt like James Bond being given an assignment; these guys knew what they were doing. Then, I was sent back to Ottawa to be medically cleared for deployment and happily received a generous number of vaccinations.

Due to the fluidity of the epidemic and the changing requirements/availability of personnel, the deployment business, like the army, has the familiar "hurry up and wait" tempo. As the uncertainty and anxiety increased, I started to think that maybe I would not deploy at all. So I let some people know that it was likely that I would go, but I didn't want to tell everyone in case it just didn't work out. Nevertheless, the word did get out and I was moved by how many of my friends and colleagues came up to quietly say thank-you for helping, or that they were proud of me. Others offered to drive my kids to hockey practices or take them to tournaments. I received emails from friends who knew that my wife would be too proud to ask for help but pleaded with me to ask them to help if needed. Finally, on December 15, the veil of uncertainty was lifted: I received a message along with three other colleagues that we would be heading to West Africa on December 30th. The travel group at the NML had our tickets ready to go; all we had to do was show up at the airport.

On December 31, 2014, after a 36 hour journey I found myself stepping out onto the tarmac into the sticky heat of Lungi International Airport in Freetown, Sierra Leone. The plane had been full of ex-pats from different NGOs who were all coming to help out. As I entered the terminal I received the Ebola baptism through washing my hands in bleach; a ritual that I was to repeat 10,000 times over the next 30 days. Looking around, I saw that everyone looked sweaty. Was it the heat or did they have Ebola? I wondered. Someone brushed up against me. Whoa! I jumped back. Sierra Leone is strictly a "no touch" zone. What if they had Ebola? I think, "Oh no, I have only been here five minutes and I now have Ebola." I pulled out my small bottle of Purell. It felt good on my hands like a soothing, invisible shield. Then I began my mantra: "Hand over the passport, Purell, reach for my luggage, Purell, count the millions of Leones from the currency exchange, Purell, Purell, Purell."

Stepping out into the hazy night, I saw and smelled the smoke of perpetual fires from bush clearing and burning waste. I was then immediately surrounded by men wanting to help me with my luggage. I crossed an unpaved parking lot and searched frantically in the darkness for anybody from Médecins Sans Frontières (MSF), the organization that was to host me for the next 30 days. The men who offered to help with my luggage then wanted money, along with two of their friends who appeared out of the darkness. "Do they have Ebola?" I wondered. I took out my Purell. Amidst the swirling chaos of heat, smoke, sweat and shouting that ensued, the MSF driver appeared and took my bag which immediately disappeared. A luggage receipt was pressed into my hand that miraculously reunited me with my bag in Freetown. Purell. Pulling out of the parking lot, in a minibus that would

take me to the Sea Ferry, the face of one of the men who "helped" with my bag pressed up against the window and then faded into the night. Welcome to Freetown.

Before I made it to a thoroughly modern hotel that was to serve as the nexus for both my outbound and return journeys, I had to take the Sea Ferry across the Sierra Leone River to Freetown. The minibus traveled to the ferry terminal on a road that I naively thought was the roughest road imaginable. Someone called my ticket number and I walked along a 100m dock into the inky blackness where the river and the sky had become one. An open boat, with seats for 20 loomed out of the darkness. I was provided with a lifejacket with a broken zipper that had the feel, and likely the buoyancy, of a lightweight down jacket. Two 250hp Mercury outboards sprang to life and then hurled us forward into nothingness. In the distance, the only thing that I could see was an enormous forest fire burning on the distant shore. The ride on the ferry was a pivotal experience for me. Things were so completely beyond my control, in a way that any over-riding structure in which I would normally give up this control did not exist. At this point, I realized that to move forward, to be able to perform in my job and to be happy, I needed to give myself over to Sierra Leone. That decision made all of the difference.

At 0600 the next day, my three colleagues and I, and all of the equipment needed to resupply two laboratories, were loaded into a Toyota Land Cruiser. Now this was no 5-star African safari. These Land Cruisers are built to MSF specifications. That means there are no electronics, no ABS, no rear-defroster, no A/C, the tires have tubes, you sit sideways on hard benches, and there is no turbo on this diesel. But we were lucky, our driver owned a cowboy hat and soon we found ourselves rolling into the jungle listening to real hurtin', country music. Over the next nine hours we traveled 300km from the Western to the Eastern edge of the country on roads that changed from paved, to gravel, to dirt, to "are you sure that this is a road?" During that epic journey, our aching butts and all our gear were transferred into five consecutive vehicles until our last vehicle, Bravo (B)-4 rolled up to "Kilo Base" - the Luawa Hotel Resort in Kailahun. Stepping out into the scorching 35 degree heat, someone took my temperature, I again washed my hands in bleach, presented the soles of my shoes for bleach spray before saying hello to my home for the next 30 days.

I waded through the heat, grabbed a drink and headed over to the dining area to meet some of my new MSF colleagues. Not only were the members of MSF courageous, having been on missions in Somalia and South Sudan, their skill sets were off the charts. Need a Tour de France bicycle mechanic? No problem, go talk to the guy who organizes the logistics on the base. Oh, were you thinking of holding a concert? Easy, go to the Ebola Management Centre (EMC) and ask the nurse from Ottawa who is also a concert violinist. And do you have a boat that needs to be sailed from the Caribbean to Europe? Ask the guy in charge of water sanitation. When he is not racing yachts around the world, or riding his motorcycle across Africa, he could take that sailing trip for you - solo. Chemical, biological, nuclear incidents? Trauma management? We had a Dutch doctor/nurse combination that could look after all of those. I had washed my hands in bleach again and sat down with this very talented group for my first of 30 consecutive chicken and rice dinners. After that I took the first of 30 cold showers, and only then did I crawl under my mosquito net and went to sleep. Tomorrow was a work day!

The following morning, I grabbed my malarone, a multivitamin and my all-important Purell, before heading out with my colleagues to the EMC for a hand-over briefing from the team that had been manning the Mobile Lab since December 1st. The four of us had jumped into the Land Cruiser and the driver called the radio room "Kilo Base. Kilo Base. This is Bravo-4. I have 4 Echo's (Ex-pats) on board. Heading to the EMC (Ebola Management Centre). Over." The steel gates of Kilo Base swing open and we ventured out into the half-light of dawn.

The first of my daily journeys began with a ride through semi-rural pastoral beauty populated only by sleeping dogs and the occasional ghostly midnight traveller who balanced their belongings carefully on their heads. We then passed through the small town of Kailahun which is the commercial and bureaucratic center of the district serving as the first port of call for goods travelling from Guinea. In the breaking dawn I could see half-destroyed buildings and burned out houses left standing as if to testify against the violence of the civil war that ended more than a decade earlier in 2002. The truck passed faded civic signs of national pride proclaiming the rebirth of Sierra Leone with slogans preaching cooperation and healing. We passed the mosque, adjacent to the evangelical church and, as we drove up another hill, the road was split in two by a trench formed during the rainy season that was now a month gone. The town began to stir; I saw people brushing their teeth beside the road, mothers cooking breakfast on an open fire, and pockets of little kids screaming "Poomway" (white person) and waving madly; hoping to get a wave in return. The B-4 lurched and groaned as it climbed one more hill and before we made a left turn and I caught my first sight of the EMC in the distance, literally, carved out of the jungle.

As we stepped out of the brilliant African sunlight into the darkened semi-permanent structure of the change rooms, the bleach cleansing and temperature taking rituals were repeated. Disoriented among the crush of people, I was told to ask for greens and white rubber boots - the battle dress of Ebola fighters. The clerk handed me clothing that fit me like a set of Lulu's but I was too embarrassed to ask for different ones so I immodestly stepped out of the change room. I hobbled along the rock-strewn no-man's land between the high risk (Ebola patients) and the low risk zones where the lab was located, wearing one boot that was too big and one that was painfully too small. As I walked past rows of enormous canvas tents draped with sun shades or extended with corrugated iron roofs friendly staff called out "Bee-ay-ee!" or "How did you sleep?" I didn't know how to respond, so I smiled a bewildered smile and headed to the mildewed lab tents at the far end of the EMC.

When I arrived, I opened the flaps of the first tent and entered. I saw a few familiar instruments and a freezer but when I saw the isolation tent where we opened Ebola specimens, that was where the familiarity came to an end. All the equipment was laid out on rough-hewn wood-tables that sat on a well-worn tarp covered in the ubiquitous red dirt. This did not look like any lab that I had worked in before.

Giving myself to Sierra Leone meant changing my perspective on so many levels. In Ottawa, I had spent hours carefully crafting laboratory guidelines for safely handling possible Ebola specimens under the most stringent conditions possible. Outside my new lab, staring at me from three feet away, were three white polyethylene buckets sitting in the red gravel of the EMC full of potential Ebola specimens. As I struggled to reconcile these vastly different environments, I nearly fainted as a member of the departing team sprayed a lid down with bleach and opened the container to count the number of specimens inside. I nervously pulled out my Purell, took three steps backward and looked down at my colleague who, to my amazement, was still alive and staring back at me. He asked, "Well are you going to test these specimens or what?" I grabbed my well-thumbed protocol that I had carefully annotated while training at the NML and re-read eight times on the flight down and thought: "Where do I start?" I nervously looked around to buy time and saw a giant pump bottle of Purell in the lab. I took five long pulls. It felt good as I rubbed it on my hands and I felt my courage returning. I took a breath and decided that a good place to start was "Step 1."

I had a great lab partner, Qiu, with whom I shared lab duties. She was a bit of a hot-shot, as she had developed ZMapp, the monoclonal antibodies which are probably the most effective Ebola treatment on the planet. She handled the tough stuff, wearing the full personal protective equipment and neutralizing the "hot" specimens before handing them off to me but nonetheless, I was critical to the operation. I got the satellite connection to the internet running in the morning, then hooked up the router to the PCR machines, and removed insects, lizards and rats from the tent. I reminded her that I was not completely useless. My other duties included purifying the viral RNA from the neutralized specimens and then running the Ebola testing. But this point should be made absolutely clear: I was just a guy who had a passport, a lot of support and lab experience. The real magic came from the people in the Special Pathogens Laboratory at the NML who developed the tests and worked in the mobile labs for most of the Ebola outbreaks that had occurred in Africa.

Over the next month, in two tents in the middle of the jungle, with intermittent diesel generator-supplied power, we ran hundreds of Ebola tests without a single failure. After working in an NML diagnostic laboratory it was amazing to see this field lab providing results that were every bit as robust and reliable as those that could be obtained in those spotless facilities back home. On our first day we tested for Ebola, as well as for Malaria and Lassa fever. This day we found no Ebola, only malaria. With the laboratory work complete and the equipment decontaminated, I reported the results to the EMC medical team, changed out of my tight clothing, got bleached again and climbed back into the Land Cruiser for the return to Kilo Base.

After 30 straight days of the same meals, the same trips, the same tight clothes, the same laboratory testing, it all came to an end. Qiu had moved on to another field lab and I was left alone at the EMC. As the sun set, I watched the smoke drift away from the burning of the now vacant tents in the high risk zone. As the last man standing, in an EMC devoid of Ebola cases, I looked around and knew that my work was done. I packed up the lab, loaded the equipment into a pick-up truck, Purelled my hands, climbed into the B-4, and listened for the last time to the driver who made his radio call: "Kilo Base, Kilo Base. I have one Echo on board. Coming to your location." I was going home.

My bags were loaded in the back of B-4 as I waited at Kilo Base. I heard the thump-thump-thump of the helicopter growing louder, my cue to run to B-4 for the ride to the soccer stadium where I would meet the UN helicopter that would take me to Freetown. As the helicopter lifted off, waving children scattered like leaves in the wind, and I began to reflect on my experience. I thought about the relationships built with the national staff and their efforts to

teach me the local Mende language. I marveled at the synergy that existed between the NML's mobile laboratory and MSF. The reputation of MSF gave us the freedom to work safely and effectively in Sierra Leone. The organization has been superbly managed and has made a tremendous contribution to the West African Ebola epidemic through their early and courageous assistance. However, MSF did not have a lab to test patients for Ebola or, when patients survived, to determine whether they could be safely discharged to their families. The mobile lab provided this diagnostic piece that allowed the EMC to function. Although I did not see any Ebola cases during my 30 days in Sierra Leone, the 450 bodies lying in the graveyard beside the EMC silently testified that Ebola had been there. During the six months the field lab had been operating, more than 2700 tests had been performed on 1200 admissions. In total, twenty-one remarkable PHAC employees travelled to Sierra Leone to staff the mobile laboratories in Kailahun and Magburaka, with every one making an enormous contribution on behalf of Canada.